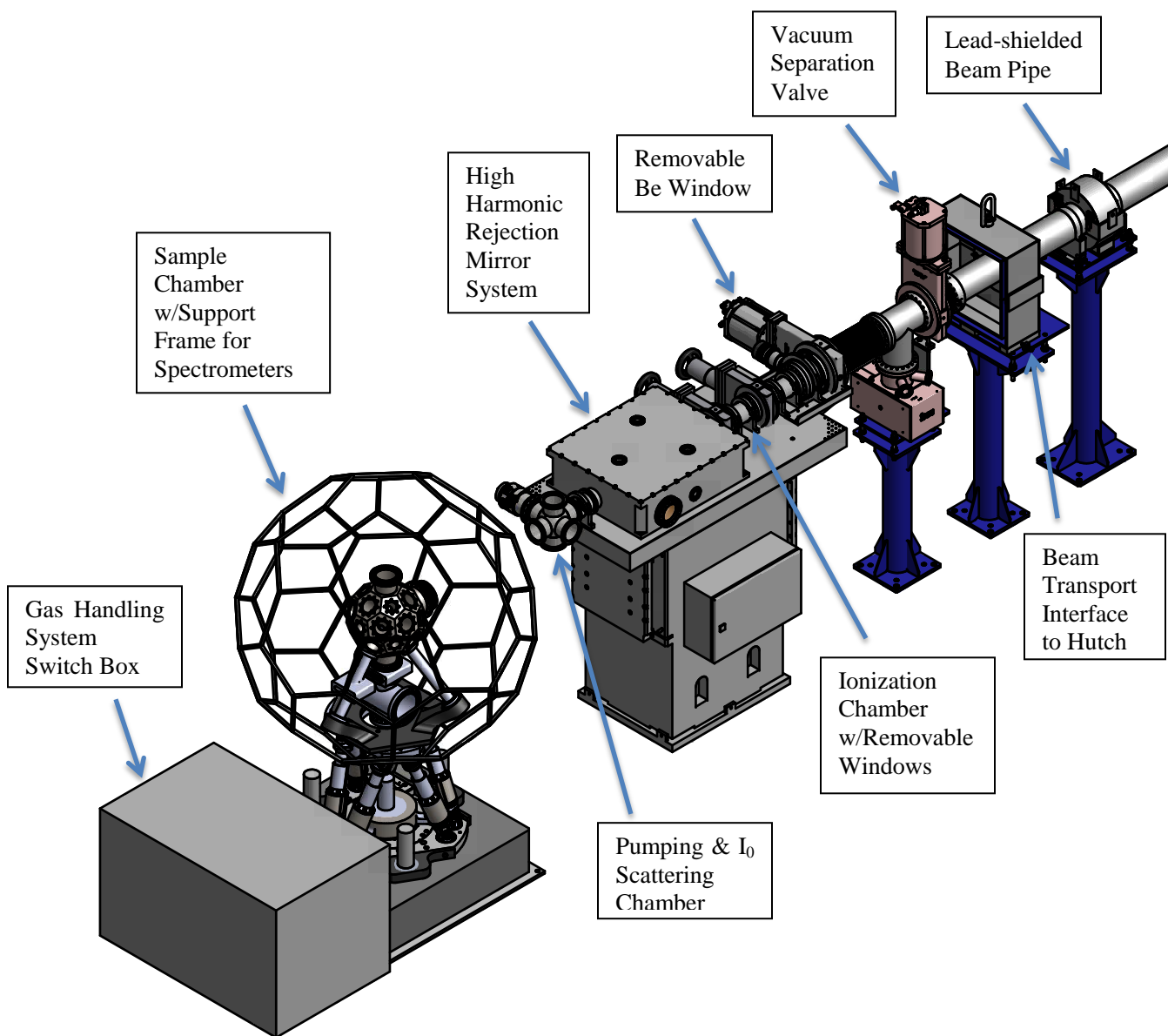


NSLS-II Experimental Tools (NEXT)

May 2015 Project Activity

Report due date: June 20, 2015



Rendering of the ISS Endstation at 8-ID

OVERALL ASSESSMENT

During May 2015, progress continued to be made on all phases of the project, including awarding major procurements, finalizing endstation designs, and installations.

Three major procurement contracts were awarded during May, for: EPU current strip power supplies on the 8th, controls servers on the 19th, and vacuum stages for SMI on the 20th. Upcoming major procurements include the sample manipulator for SIX, X-ray emission spectrometers for ISS, and the sample handling system for ISS. As of the end of May, 94% (59 of 63) of all major procurements for NEXT have been awarded.

Four PCRs were approved in May, all related to contract awards or amendments, with a net cost increase to baseline of \$2K: PCR NEXT_15_085 (WBS 2.08.02, ISS Beamline Systems, +\$63K change to baseline) implemented contract award of the High Harmonic Rejection Mirror. PCR NEXT_15_082 (WBS 2.07.02, ISR Beamline Systems, -\$94K change to baseline) implemented contract award of the Instrumented Six-Circle Diffractometer. PCR NEXT_15_080 (WBS 2.03.01, Common Systems Utilities, +\$8K change to baseline) implemented an amendment to the LN2 distribution contract. PCR NEXT_15_086 (WBS 2.05.02, ESM Beamline Systems, +\$25K change to baseline) implemented ESM and SIX contract awards and modifications.

BAC rose \$0.01M in May, to \$81.11M. EAC rose \$0.2M, to \$82.7M. The largest contributors to the -\$1.6M VAC at this point are expected overruns in project support (\$0.6M) and common systems (\$0.5M), plus overages expected from upcoming procurement awards in WBS 2.07 (ISR beamline, \$0.1M) and WBS 2.08 (ISS Beamline, \$0.4M).

As of May 31, 2015, the project is 48.7% complete. Cost contingency is reported at \$8.89M, which represents 21.4% of \$41.6M BAC work remaining or 20.6% of \$43.2M EAC work remaining. If all of estimated VAC were to materialize, contingency would be reduced to \$7.28M, which represents 16.8% of \$43.2M EAC work remaining. With outstanding commitments totaling \$21.7M, the \$7.28M contingency on EAC represents 34.5% of \$21.1M unobligated EAC work to go.

The cumulative EVMS schedule index remained steady in April, at 0.97. The cumulative EVMS cost index fell 0.02, to 0.99, resulting from a number of accruals and payments processed in May.

Acceptance testing of NEXT shielded enclosures (hutches) made further progress in May, with 95% of the tests completed by the end of the month.

COMMON SYSTEMS

NEXT mechanical and electrical utilities finish work proceeded in May, following completion of installation of the majority of these systems for NEXT beamlines in April. ISR utilities are now completely installed, while SMI and ESM utilities installation are both approximately 95% complete.

Utilities installation on the SIX and ISS beamlines also made good progress, with both beamlines approximately 95% installed.

The installation of the NEXT liquid nitrogen distribution piping was successfully completed in April by Acme Cryogenics. Final testing reports were received by BSA in early May and this contract is now closed.

PPS design and development is well underway, with a focus on the interlock conduit installation. This month, PPS interlock conduit installation of the A and B chains continued at SMI and started at ISR. In addition, the PPS team has been developing plans for rework of hutch interface points for compatibility with PPS hardware. The hutch suppliers have been engaged regarding remediation of mechanical interfaces. The majority (90%) of Personnel Protection System (PPS) components have been received through April. PPS installation work, while being part of one month behind schedule, is expected to accelerate in June as resources currently allocated to ABBIX become available.

The EPS team is continuing to receive EPS requirements for each beamline, and participates actively in design reviews with vendors so that interface points between EPS and photon delivery components can be understood early. The procurement of Equipment Protection System (EPS) components is approximately 80% complete through May, with components continuing to be received as system definition matures. EPS chassis are being assembled and free issued to suppliers for connection and testing prior to delivery. Installation of EPS components is expected to start in late FY2015, as beamline equipment is installed.

Control station furniture for ESM and ISS has been received and the supplier is expected to return to NSLS-II in June to install the furniture at each beamline. SMI furniture has been finalized and the contract awarded.

The May EAC log contains seven entries for utilities systems, totaling \$250K direct. The largest of these is additional electronics racks needed for the SIX beamline, amounting to \$175K direct (M&S plus labor). The EAC log also contains \$38K direct for Area Radiation Monitors (one required for each beamline) and \$90K direct for additional required EPS hardware. The EAC items will be added to NEXT scope in forthcoming PCRs.

BEAMLINE CONTROLS

Beamline controls engineers actively participated in design reviews held in May, including four for ISR: FDR of the ISR gas handling system, FDR of the Dual phase plate (DPP) system (ISR), FDR of the beam transport contract, and PDR for the Instrumented Six-Circle Diffractometer. Controls engineers also participated in the SIX endstation review. Of particular interest for controls, the SIX sample chamber design has changed significantly, replacing the previous rotatory seal design (simple motion) with a triple-rotating flange (complex coordinate motion). As a consequence,

controls staff plan to work closely with mechanical engineers to build a prototype triple-rotating flange unit to be used for controls testing and refining the complex motion programming.

During May, controls engineers provided support for testing of the ESM sample transfer motion system, especially with regard to motion tuning and controls diagnostics. Motion controls tuning and scripting work also continues at the ISS motion controls test stand. In addition, ISS FPGA ("Pizzabox") development has progressed to the point that procurement of parts for assembling the first batch of 10 production units is underway.

Procurement of controls equipment continued in May with the ordering and receipt of the first batch of GigE diagnostic cameras. Acceptance testing of these cameras is underway. Discussions are underway with ESM beamline scientists regarding the proper selection of camera lenses to image the micron-sized beam at the ESM sample position. Five channel-archiver servers, one for each NEXT beamline, were ordered in May. Following the endstation reviews held in March, April, and May, controls engineers are working with beamline scientists to determine their requirements for data acquisition servers and user data storage. Requirements for ESM and SIX were nearly finalized in May and procurement is planned in June.

Planned controls installation activities, beginning with cable pulling, were delayed in May as the technicians were tied up with ABBIX beamline installations. During May, effort from other divisions at BNL was sought to fill out a second cable pulling crew to work on NEXT installations. An additional crew, led by an experienced NSLS-II cable puller, was identified, to start on NEXT controls installations in June. At the same time, controls engineers are preparing the final cable pull sheets, incorporating the latest design changes.

ESM – ELECTRON SPECTRO-MICROSCOPY

Much of the ESM effort in May was devoted to receipt and initial installation of the ESM VLS-PGM monochromator at 21-ID, the first major piece of ESM optical equipment to be delivered. Installation required several steps and involved staff from a number of groups, working together with the supplier (Bestec) to ensure proper and efficient installation. The process began with the NSLS-II survey group providing an accurate mapping of the entire 21-ID experimental floor space (results shown in the April activity report). The survey informs the thickness of shims needed to support the instrument at the correct height. Several survey reference points are used to identify position and height of the ESM x-ray beam and permit the grating rotation axis within the VLS-PGM chamber to be positioned accurately. For this monochromator, Bestec staff positioned and aligned the system using an optical theodolite and the NSLS-II survey group verified the alignment. The results were quite encouraging. For example the height of the grating axis was found to deviate less than 300 μm from the ideal value as the

grating axis is rotated over its entire angular range (from -1° to 20°). Similarly, Bestec staff positioned and aligned the entrance and exit masks of the monochromator and the two high precision exit slits, one for each of the two ESM branches (μ -ARPES and XPEEM). The final alignment step was to verify the "fiducialization" survey values, which accurately relate the absolute position of several reference points located externally to the monochromator and exit slit chambers to relevant positions and angles of internal components (see Figure 1). The fiducialization values will allow survey checks of the positions and angles of the internal optics with respect to the rest of the ESM beamline and the NSLS-II storage ring without needing to break vacuum and open the vacuum chambers.

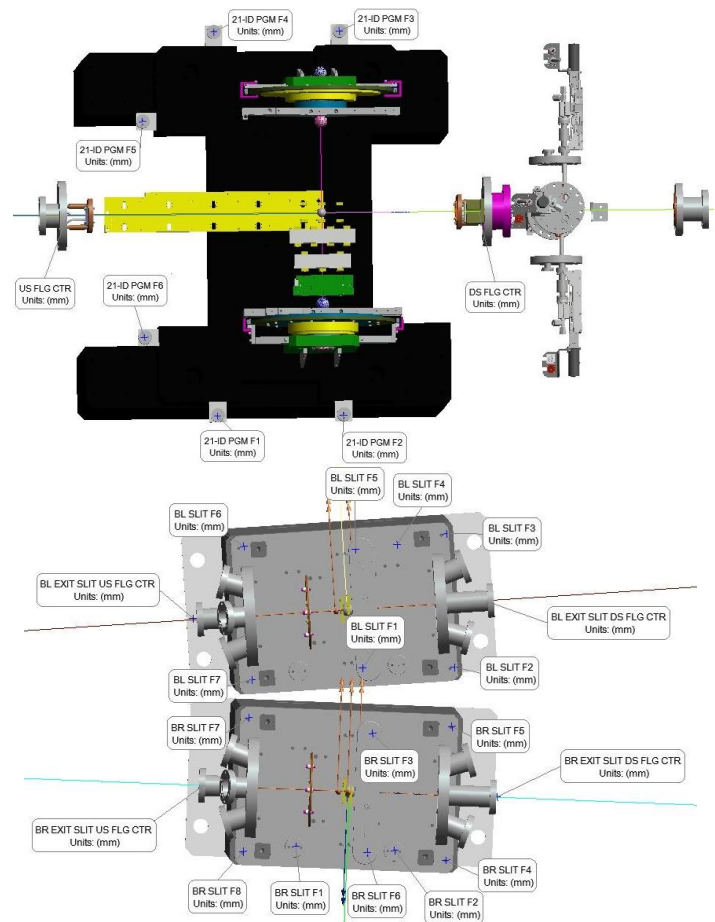


Figure 1: Top: schematic rendering of the ESM monochromator inner mechanism, granite blocks, and masks. Bottom: exit slits of the μ -ARPES and XPEEM branch lines. These renderings are extracted from the survey report and detail the locations of the survey fiducialization points.

After this initial alignment of the VLS-PGM and exit slits, all motions were checked for functionality and the systems were pumped down for vacuum testing.

The monochromator optics (plane mirror and gratings) are expected to be delivered this summer, which will provide sufficient time to verify their optical quality and be ready for installation and final alignment in December 2015. As mentioned above, at the moment the entire monochromator rests on three metal disks. Only after the final alignment is

The PDR for the Instrumented Six-Circle Diffractometer was held at BNL on May 18. Huber described the design of the five components of this system: translation rails, table, diffractometer, polarization analyzer, and cryostat carrier. There were no significant design issues, and no modifications to the table or cryostat carrier are required. As for the other components, the translation rails require an increase in the travel range, the diffractometer requires provisions for mounting a fluorescence detector, and the polarization analyzer requires a rotatable flange so that it can be rotated about the incident beam without breaking vacuum. The FDR for the Instrumented Six-Circle Diffractometer is tentatively scheduled for the week of July 6.

The FDR for the Shielded Transport Pipes was held at BNL on May 20. There were several key elements absent in the design proposed by Toyama, such as support stands for the downstream ends of the two pipes, hatch interfaces that accommodate non-normal incidence of the pipes to the hatch walls, and ports to enable the pipes to be pumped down and have their pressures monitored. Interference between the differential ion pump enclosure and the stairs to Hatch B, which was noted at the PDR, also remained an issue. The pump enclosure and its stand need to be narrowed on the inboard side by ~4", and FEA will need to be repeated to ensure the structural soundness of the modified stand design. Resolution of these issues is underway.

Two linear slides for the changeover pipes were delivered in May, and one was mounted on the changeover stand for testing. The stand for the laser, which will be used for *in-situ* studies during pulsed laser deposition growth, was assembled. A walkthrough for PPS installation for Hutches A and B occurred on May 19, and installation of conduit and cabinets began later that week. Emergency power for the safety components of the Gas Handling System was installed in Hutch D.

The FXI photon delivery system procurement contract was awarded, off project, to Toyama Co., Ltd. on May 15.

ISR – IN-SITU AND RESONANT HARD X-RAY

Purchase orders for gate valves, ion pumps, and a second changeover stand were placed. All of these components are expected to arrive in June.

With the final iteration on the primary shielding design completed by Toyama, progress on the design of the PPS Aperture was made, and its preliminary design is shown in Figure 2. The single-aperture device will be located immediately upstream of the Fixed Aperture Mask (FAM) in the FOE and will trigger a beam dump in the event that the beam strays toward the inboard aperture in the FAM.

Note that this inboard aperture will only be utilized after the canted build-out of the ISR beamline, which is not in the scope of the NEXT Project. In other design work, the design of the differential pump was finalized. This component will be located between the SOE and Hutch C, and will protect the Double Harmonic Rejection Mirror from any contamination in the endstation changeover pipes, which will only achieve a high-vacuum state.

The FDR for the Gas Handling System was held at BNL on May 13. The agenda items included: overall layout, overall schedule, safety issues (e.g., gas detection and fire safety), controls, and installation. The overall layout of the system now conforms to the ICD following redesign by the contractor (Applied Energy Systems) of the vented enclosure from a single module to a 4-piece module. Regarding schedule, the contractor stated that their delays in completing final design will likely delay delivery and installation of the system; when updated schedule information is available, analysis of the effect on the ISR schedule will be performed and, if acceptable, a contract amendment will be issued.

The FDR for the Dual Phase Plate Assembly was held at BNL on May 15. The final design of the vacuum chamber that has been subcontracted to PINK GmbH was not yet complete, but Huber provided an overview of its design. With regard to the mechanics of the system, there were no modifications beyond the implementation of those discussed at the PDR.

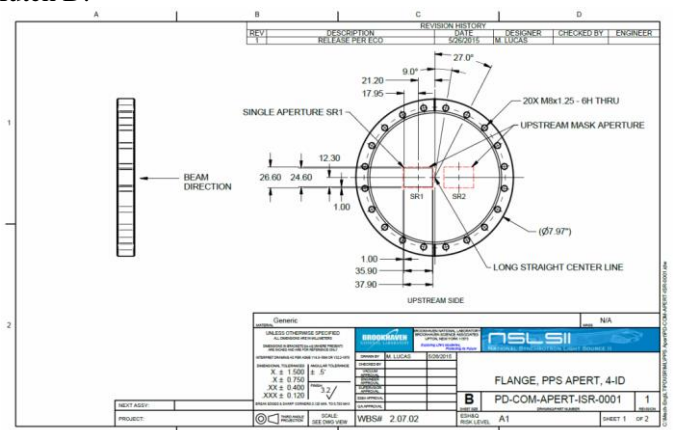


Figure 2: Preliminary design of the ISR PPS Aperture.

ISS – INNER SHELL SPECTROSCOPY

Milestones for a number of ISS photon delivery system components were achieved in May.

The FDR of the Filter Box contract was held with Toyama in May. This component, an essential element of the heat management system of the ISS PDS, was awarded in March. The final design presented at the FDR reflects significant mechanical simplification choices that conform to the standard Toyama design. These design simplifications will support on-time delivery of the system. The working schedule shows delivery of the Filter Box together with the Collimation and Focusing Mirror system in November 2015, followed by installation. Approval of the Final Design Report is expected in mid-June.

Another ISS PDS milestone achieved in May was approval of the FDR for the Beam Transport System. This system will be Toyama's first shielded beam transport system installed at BNL. To avoid the risk of radiation leaks or non-compliance with BSA design guidelines, all mechanical details such as interfaces, installation of the stainless steel cover over the lead wrapped transport pipe, design of the mini-enclosures, and QA documentation, were reviewed thoroughly. In addition, the design was revised to include additional lead shielding in the transition area between the FOE and the beam transport pipe. Simulations of the radiation background, including secondary bremsstrahlung scattering, show that the radiation background outside the beam transport will be a factor of 10 smaller than the NSLS-II radiation guideline limit.

Whereas most ISS PDS components are in the fabrication phase, the endstation equipment contracts are well into the design phase. A CDR was held in May to discuss design details of the Higher Harmonic Rejection Mirror system (see Figure 3). Minor changes were agreed upon, most of them correlated with interfaces to the sample chamber and integration of the I/O scattering chamber and slit system. The PDR for this contract will be held in June, ~2 weeks ahead of schedule.

Another key feature of the ISS endstation is the provision of X-ray Emission Spectrometers (XES) integrated into the sample chamber system. Five bid proposals for the XES procurement solicitation were received in May. The scope of this procurement package includes mechanical aspects of two types of spectrometers: spherical backscattering and von Hamos, as well as mechanical engineering and design of the large external support frame surrounding the sample chamber, to which the spectrometers will be mounted. Award of the XES procurement package is expected in June.

To avoid severe design constraints imposed by payload limitations of the originally specified motorized sample chamber support system, a contract amendment to double the maximum load capacity to 2 tons was executed. The new hexapod-based system will provide a larger vertical travel range, thereby simplifying movement of the sample chamber from operational to "parking" position (letting beam pass on to the downstream section of the 8-ID-B hutch), and it will simplify the spectrometer designs and permit a significantly more rigid support frame mechanical design.

The first phase of the FAT for the Gas Handling System was conducted successfully in May. The scope of this phase included the automatic and semi-automatic gas cabinets and the manual inert gas distribution panels. The second FAT phase, to cover the gas switching system, the gas detection system, and the controls system, will be held at the end of June. Phase I installation of the system will begin in mid-June with installation of all gas cabinets, panels, the gas extraction system, and the monitoring systems. Phase II installation, to follow seamlessly following Phase I, will focus on the installation of the gas switching unit and the controls hardware and software.

ISS technical progress in May included installation of control station furniture, the support frame for electronics, and utilities inside the endstation enclosure. Connections of all electronic racks to power and cooling water have been made, and installation of electronic components in the racks has started. Installation of the fiber-optic system that will distribute Ethernet and the global timing signals to all detection systems is expected in June. Small vacuum components have been inventoried to enable efficient installation.

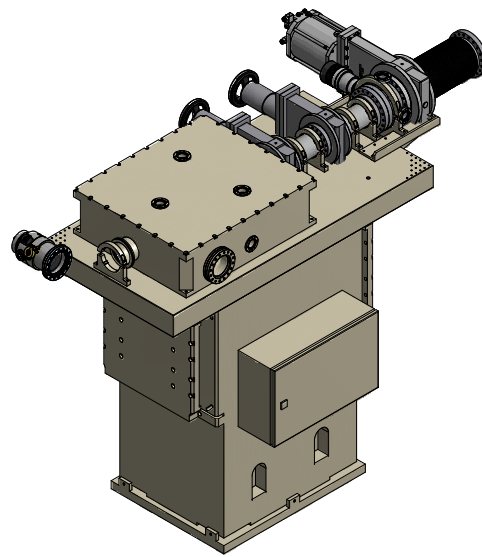


Figure 3: Rendering of the ISS Higher Harmonic Rejection Mirror (HHRM) system (rectangular chamber on the left; X-ray beam enters from right) and beam characterization and manipulation modules (on the right): a gate valve equipped with an 80 x 10 mm² Be window for vacuum separation from beamline vacuum and an ionization chamber with Frisch grid. A beam characterization system will be located just downstream of the HHRM chamber, consisting of a scattering chamber to measure IO and reference spectra and a slit system. The mirror system will be pumped by a turbo molecular pump (shown downstream of the HHRM chamber) to support various operation modes including a low energy mode in which the system is He-filled, avoiding the x-ray absorption of multiple X-ray windows.

SIX – SOFT INELASTIC X-RAY

A large portion of the SIX effort during May was directed towards preparing for and supporting initial installation of the VLS-PGM and exit slit by Bestec, which started on May 28, jointly with the installation of the VLS-PGM and exit slits for ESM. Tasks performed by SIX and NSLS-II group staff in collaboration with Bestec staff included providing the floor height map to Bestec, booking the survey group and their equipment, coordinating the machining of the PGM shims, and refining the installation strategy and schedule with Bestec. The photo in Figure 4 shows the SIX PGM being moved to its location on the experimental floor on May 28. In Figure 5, Bestec staff are shown aligning the exit slit unit in SEB2 using two orthogonally aligned theodolites. The installation is scheduled to be completed on June 5. All other PDS procurement contracts are currently in the production phase.

The PDR for the endstation spectrometer arm system was held by phone with Bestec on May 11. The most noteworthy progress since the pre-PDR meeting held at Bestec in April was the revised mechanical design of the optics tank mechanics, shown in Figure 6. This design successfully accommodates the recently added vertically deflecting 0.5m-long plane mirror M7, located between the M6 mirror and the gratings, without any interference. The optical pitch axes of M6, M7, and the gratings are each actuated by an independent sine bar. Stability measurements performed by Bestec on their PGMs, where similar sine-bar mechanisms have been implemented, ensure that our stringent pitch stability requirements on the M7 and grating pitch axes (30 nrad each) can be met.

Regarding the optics, the second of the two internally cooled mirrors contracted to InSync, M1, was received on May 8. This mirror is currently awaiting verification of the 100 nrad longitudinal slope error by the NSLS-II metrology group. Production of the elliptical mirror M3 and the ellipsoidal mirror M4 by JTEC Corp. is on schedule. Shipping of the cylindrical mirror M6, originally planned for May 22, has been delayed by a month, which will not have any impact on the installation schedule of the spectrometer.

The FDR of the CCD detector for the spectrometer was held by phone with XCAM on May 11. No major changes were made since the PDR, which was expected since significant design effort had already been put into the preliminary design. The final design was approved right away.



Figure 4: SIX PGM on the 2-ID experimental floor during installation on May 28.



Figure 5: Bestec staff aligning the PGM exit slit on the SEB2 experimental floor during installation.

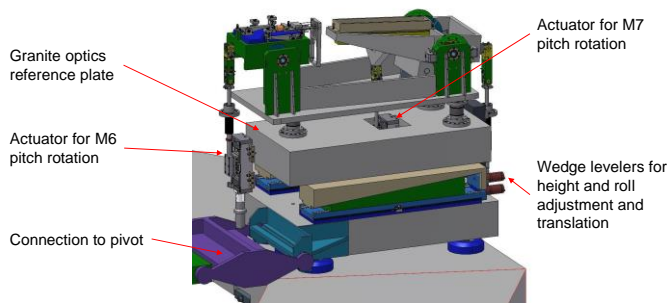


Figure 6: Rendering of the preliminary design of the SIX spectrometer optics tank mechanics presented during the PDR with Bestec.

SMI – SOFT MATTER INTERFACES

Progress on the SMI beamline has advanced to the point where all components, whether handled as a major procurement, a small requisition, or an in-house design, are active and commanding attention. For the White Beam Components (IDT), Cryo-Cooler (Bruker), and Sample Vacuum Chamber (GNB), factory acceptance tests (FAT) and delivery are imminent. Figure 7 shows two of the progress photos recently received. For these contracts, activities now being organized for June, July, and August include travel for FAT, development of inspection test reports and installation travelers, and preparation for the installations and acceptance testing.

Final Design Review (FDR) of the H-V Mirrors and SSA package (Cinel), a major milestone for this contract, was approved in May. The FDR report and minutes for the CRL Transfocator contract were received from JJ X-ray in May, one month ahead of schedule.

The SMI Vacuum Sample Stages contract has been awarded to Physik Instrumente and will consist of two hexapods and a rotation stage. This system will feature thirteen degrees of freedom, which will allow the GISAXS experimenters great flexibility in controlling the illuminated area, large reciprocal space access, and microbeam scanning capability. Kick-off and Design Review meetings will begin in June and conclude in August, and the components will be delivered in May 2016.

Bid proposals for the Double Crystal Deflector proposal are due at the very end of May.

As a result of focused activity in May, the design and plan for the SMI X-ray Beam Position Monitors (XBPMs) is now mature. Functional specifications for XBPMs were included in the White Beam Components and H-V Mirrors procurement packages but the sensors were included as options. This approach was chosen so that state of the art sensors could be obtained, as late in the project as possible, and so that the choice of vendor for the beamline optical components could be decoupled from the choice of vendor for beam monitors. This is especially important for SMI because tender energy X-rays do not transmit through thick sensors, and development of appropriate sensors is in its infancy. At

the SMI BAT meeting in January 2015, the design and calculated performance of instrumented diamond XBPMs perfected by the BNL Instrumentation Division were presented. Two SMI BAT members have experience with early developments in thin diamond sensors at their ESRF beamlines, and the BAT discussed the publications and prospects. Now, SMI has established a collaboration with the BNL Instrumentation Division to produce superior thinned diamonds for tender x-rays, 2-4 keV. At the same time, the device must suit the needs of the higher energy range, 6-24 keV, also needed for SMI. The design developed by BNL Instrumentation is shown in the upper panel of Figure 8. The standard electronics grade single crystalline diamond plate is 4mm across and 0.5mm thick. In standard sensors, the surface of a 3mm wide active area is prepared by appropriate polishing and is patterned with a quad layout of photocurrent pads separated by a thin “street” area. The standard sensors are typically cut and polished to thicknesses of about 40 μ m, appropriate for hard x-rays. The novel design for operation at tender X-ray energies involves developing a new and better method of thinning a window area, 1.2mm across, to a thickness of 4 μ m. This development and prototyping work will be undertaken by BNL Instrumentation. The resulting plate will be patterned with six pads making two quad regions, one for tender x-rays and the other for the high energy range. In Figure 8, orange ellipses indicate the range of beam sizes on the devices: the large circle represents the 0.9mm diameter, 2.1keV beam at XBPM1 (located just downstream of the beam stops) and the small ellipse is the 20 keV beam in microfocus mode projected onto XBPM3 (located a few meters upstream of the focal point). In this type of detector, the resolution can be as good as 0.1% of the beam width, which is better than required for SMI. Execution of the XBPM plan consists of (i) outsourcing the device packaging and (ii) in-house engineering of brackets, feedthroughs, and off-the-shelf in-vacuum translation stages for installation in the XBPM chambers being provided by the H-V Mirrors contract (Cinel). The chamber design is shown in the lower panel of Figure 8. The XBPM current will be detected by 4-channel electrometers built by the NSLS-II Detector Group. Four such electrometers were purchased by SMI and have been delivered and tested using the included EPICS IOCs. Completion of the SMI XBPM devices is projected for March 2016.



Figure 7: Upper panel: SMI White Beam Slits, fabricated by IDT, ready for acceptance testing. Lower panel: SMI Sample Vacuum Chamber waterjet cut plates being prepared for welding at GNB.

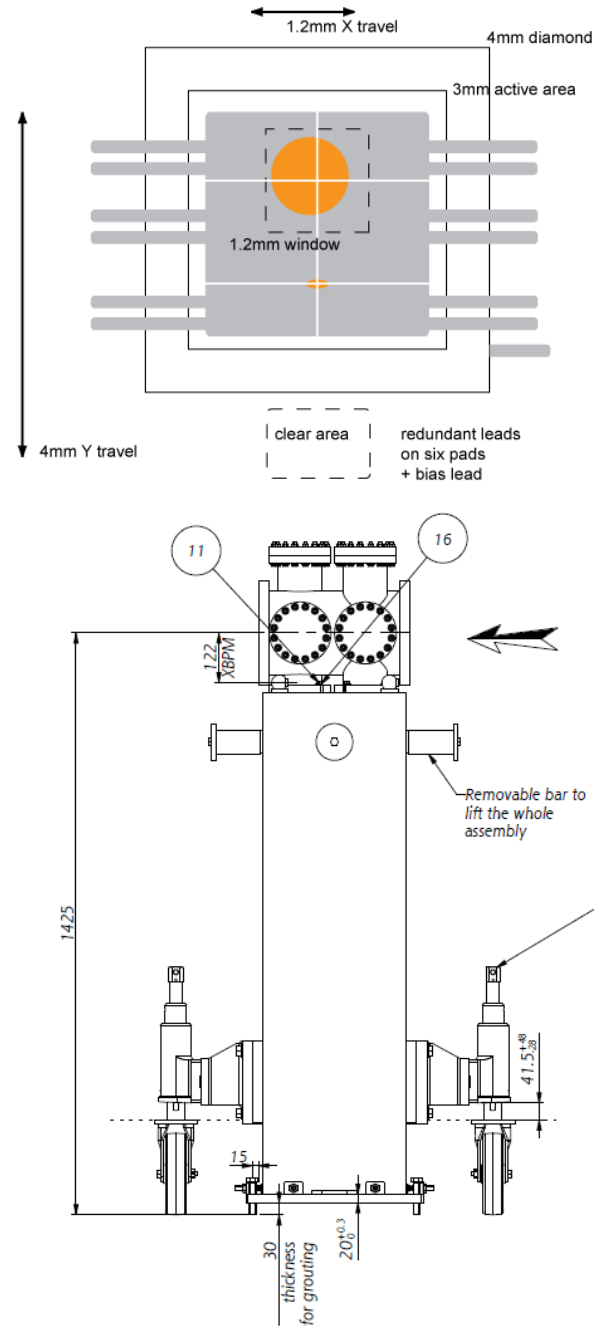


Figure 8: Upper panel: Schematic design of the SMI instrumented diamond beam position monitor, which will have an upper quad pattern (Pt pads and leads indicated by gray color) for the tender x-ray energies (2-4 keV) and a lower quad pattern for higher energy x-rays (6-24 keV). A 1.2mm region of diamond thinned from 40 μ m to ~4 μ m, indicated by the dashed line, will enable tender x-ray transmission with good efficiency and signal level. Orange ellipses indicate the largest and smallest anticipated beam sizes relative to the sensor. Lower panel: detail from a CAD drawing of an XBPM chamber being provided in the H-V Mirrors package (Cinel).

INSERTION DEVICES

Final design of the long EPU's (2.8m-long EPU105 for ESM and 3.5m-long EPU57 for SIX) continued by the contractor (Kyma) in May. The FDR for this contract, originally planned for May, will be held in June following the NSLS-II facility maintenance period ending May 29. The NEXT Insertion Devices CAM (Kitegi) is working with Kyma to minimize the impact of this few-week delay on the long EPU's contract schedule.

Requirements for the current strip power supplies were refined in May for procurement (RFQ) in June.

ID/FE INSTALLATION

During this month, the pulling of the vacuum cables for the NEXT front ends was completed. Wiring of the safety shutters, fitting the lead shielding, and running the compressed air tubing among components is continuing on the ESM, ISS, and SIX front end assemblies. Installation work will continue during maintenance days.

Installation of the front ends is behind the baseline schedule (cumulative SPI is 0.44), but well within the time frame that is needed to be completed prior to completion of the corresponding beamline installations. The schedule delay to date has resulted mainly from labor being devoted to finishing ABBIX project installation, in addition to the known schedule impact of limited access to the SR tunnel during operations.

During May there was no NEXT insertion device installation, as the IVU23 devices were still being measured in the magnetic measurement lab. During the latest phase of magnetic measurements, additional fine adjusters have been

added to the devices to improve their spectral performance. Testing of the insertion device control system is also ongoing in the magnetic measurement lab.

PROJECT MILESTONES

Milestone	Planned	Actual
CD-0 (Mission Need):	May 27, 2010	May 27, 2010
CD-1 (Alternative Selection):	Dec. 19, 2011	Dec. 19, 2011
CD-2 (Performance Baseline):	Oct. 9, 2013	Oct. 9, 2013
CD-3A (Long Lead Procurement):	Oct. 9, 2013	Oct. 9, 2013
CD-3 (Start Construction):	Mar. 31, 2014	Jul. 7, 2014
Internal Early Project Completion – Beamlines	Sept. 30, 2016	
Early Project Completion:	Jan. 31, 2017	
CD-4 (Project Completion):	Sept. 29, 2017	

UPCOMING EVENTS

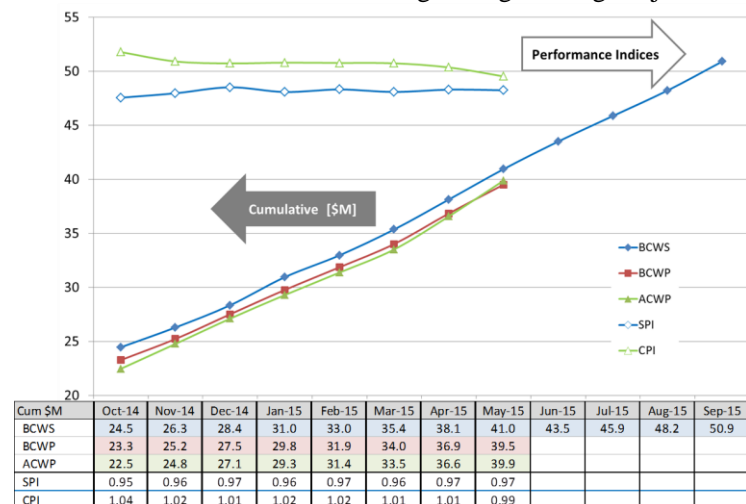
BNL EVMS Surveillance Review	June 29 – July 1, 2015
DOE/SC Status Review	November 2015 (tentative)

Acronyms and Abbreviations

ABBIX	Advanced Beamlines for Biological Investigations with X-rays	ICD	Interface Control Drawing
ACWP	Actual Cost of Work Performed	ID	Insertion Device
APP	Advanced Procurement Plan	IDT	Insertion Device Team
ARPES	Angle-Resolved Photoemission Spectroscopy	I/O	Input/Output
BAC	Budget at Completion	IOC	Input/Output Controller
BAT	Beamline Advisory Team	ISR	Integrated In-Situ and Resonant X-ray Studies
BCWP	Budgeted Cost of Work Performed	ISS	Inner Shell Spectroscopy beamline
BCWS	Budgeted Cost of Work Scheduled	M&S	Material & Supplies
BNL	Brookhaven National Laboratory	NEXT	NSLS-II Experimental Tools project
BSA	Brookhaven Science Associates	NSLS-II	National Synchrotron Light Source II
CAD	Collider Accelerator Division	OPC	Other Project Costs
CAM	Cost Account Manager	PCR	Project Change Request
CCD	Charge-Coupled Device	PDR	Preliminary Design Review
CD	Critical Decision	PDS	Photon Delivery System
CDR	Conceptual Design Report	PGM	Plane Grating Monochromator
CPI	Cost Performance Index	PMB	Performance Management Baseline
CRL	Compound Refractive Lens	PPS	Personnel Protection System
CV	Cost Variance	QA	Quality Assurance
DOE	Department of Energy	RFQ	Request for Quote
DPP	Dual Phase Plate	SAXS	Small Angle X-ray Scattering
EAC	Estimate at Completion	SC	Office of Science
EPS	Equipment Protection System	SEB-2	Satellite Endstation Building 2
EPU	Elliptically Polarizing Undulator	SIX	Soft Inelastic X-ray Scattering beamline
ESM	Electron Spectro-Microscopy beamline	SMI	Soft Matter Interfaces beamline
ESRF	European Synchrotron Radiation Facility	SOE	Secondary Optics Enclosure
EVMS	Earned Value Management System	SPI	Schedule Performance Index
FAM	Fixed Aperture Mask	SR	Storage Ring
FAT	Factory Acceptance Test	SSA	Secondary Source Aperture
FDR	Final Design Review	SV	Schedule Variance
FE	Front Ends	TEC	Total Estimated Cost
FEA	Front End Apertures	TPC	Total Project Cost
FOE	First Optics Enclosure	UB	Undistributed Budget
FPGA	Field-programmable Gate Array	VAC	Variance At Completion
FTE	Full Time Equivalent	VLS	Vapor Liquid Solid
FXI	Full-field X-ray Imaging beamline	WBS	Work Breakdown Structure
FY	Fiscal Year	XBPM	X-ray Beam Position Monitors
GISAXS	Grazing-incidence Small Angle X-ray Scattering	XES	X-ray Emission Spectrometer
HHRM	Higher Harmonic Rejection Mirrors	XPEEM	X-ray Photoemission Electron Microscopy

COST AND SCHEDULE STATUS

Cost and schedule progress is being tracked using an Earned Value Management System (EVMS) against the cost and schedule baseline established on October 1, 2013. All baseline changes are being controlled through the NEXT Change Control Board. Cost and schedule revisions are being managed using Project Change Control procedures.



The NEXT project Schedule Variance (SV) for May 2015 is -\$143K, with an associated monthly Schedule Performance Index (SPI) of 0.95 (green status). The cumulative SPI is 0.97 (green status), the same as it was in April 2015. The negative current month schedule variance is the net result of a number of contributors, both positive and negative. The largest are: -\$196K in WBS 2.04 (Control Systems) resulting from less-than-planned installation of cables and slower-than-planned development of device engineering screens and testing of IOC applications in May, +\$144K in WBS 2.09 (SIX beamline) resulting from value earned in May for M1 mirror delivery, detector design review, and M1/M3 chamber progress, all three of which were scheduled for an earlier month, +\$104K in WBS 2.11 (Insertion Devices) resulting from value earned in May on both

EPU contracts which was scheduled for an earlier month, and -\$152K WBS 2.12 (ID/FE Installation) resulting from fewer-than-planned front end stands installed in May.

The NEXT project Cost Variance (CV) for May 2015 is -\$639K, with an associated monthly Cost Performance Index (CPI) of 0.81 (red status). The primary contributors to the monthly CV in May are: -\$89K in WBS 2.01 (Project Management & Support) resulting from greater than planned procurement-related labor charges and purchase of portable vacuum equipment needed to support vacuum work at all NEXT beamlines, -\$239K in WBS 2.03 (Common Systems) primarily attributed to additional scope and rework that has been needed within utilities, +\$217K in WBS 2.05 (ESM Beamline) resulting from value earned for achieving a milestone in the electron energy analyzer contract and delivery of the VLS-PGM, for which no payment or accrual has yet been processed, -\$149K in WBS 2.08 (ISS Beamline) resulting from payment in May for the Mythen detectors received in March, and -\$359K in WBS 2.09 (SIX Beamline) resulting from payments made for work previously accomplished for the VLS-PGM and XCam detector procurements. The cumulative CPI is 0.99 (green status).

As of May 31, 2015, the project is 48.7% complete with 21.4% contingency (\$8.9M) for \$41.6M Budget At Completion (BAC) work remaining, based on PCRs processed and approved through May 2015.

The project EAC for May is reported at \$82,719K against a Performance Measurement Baseline (PMB)/Undistributed Budget (UB) of \$81,112K. The Variance At Completion (VAC = BAC - EAC) of -\$1,607K represents the sum of contributors to EAC which have not been added to baseline via PCRs. The major contributors to VAC at the end of May include: -\$0.6M in WBS 2.01.02 (Project Support) for estimated overruns in this account (related to procurement effort and vacuum equipment supporting all NEXT beamlines), -\$0.5M in common systems for estimated overruns in WBS 2.03.01 (Utilities) and additional required PPS and EPS hardware in WBS 2.03.02 and WBS 2.03.03, respectively, -\$0.1M in WBS 2.07 (ISR Beamline) for upcoming procurement awards, and -\$0.4M in WBS 2.08 (ISS Beamline) for procurement contract amendments and additional DAQ hardware. The expected overruns in Utilities include additional electronics racks for SIX and utilities systems required for the gas handling systems at ISS and ISR (emergency power, exhaust connections).

The contingency (\$8.9M) is 20.6% of \$43.2M EAC work remaining.

4 PCRs were approved and implemented in May.

PCR	PCR Level	Baseline Change [\$]	Description
PCR-15-085	L3	62,845	APP036 High Harmonic Rejection Mirror Contract Award
PCR-15-082	L3	(94,120)	APP097 Instrumented Six Circle Contract Award
PCR-15-080	L3	8,235	LN2 Contract Amendment
PCR-15-086	L3	24,970	SIX & EXM Contract Awards and Mods

Forthcoming PCRs include (i) a Level 3 PCR (NEXT_15_088) to implement contract awards and amendments in WBS 2.10 (SMI Beamline), (ii) a Level 3 PCR (NEXT_15_083) in Common Systems Utilities (WBS 2.03.01) to provide additional equipment racks for SIX, and (iii) a Level 3 PCR (NEXT_15_089) for award of Linux servers and additional control cables in WBS 2.04 (Beamline Controls).

NEXT as of 5/31/2015	Current Period	Cum-to-Date
Plan (BCWS) \$K	2,809	40,951
Earned (BCWP) \$K	2,666	39,518
Actual (ACWP) \$K	3,305	39,890
SV \$K	-143	-1,433
CV \$K	-639	-371
SPI	0.95	0.97
CPI	0.81	0.99
Budget at Completion \$K (PMB [UB])		81,112
Planned % Complete (BCWS/BAC)		50.5%
Earned % Complete (BCWP/BAC)		48.7%
Contingency \$K		8,888
Contingency / (BAC – BCWP)		21.4%
EAC \$K		82,719
Contingency / (EAC – BCWP)		20.6%
(Contingency + VAC) / (EAC – BCWP)		16.9%
TPC = PMB + Contingency		90,000

SPI Project to Date*:

0.97

CPI Project to Date*:

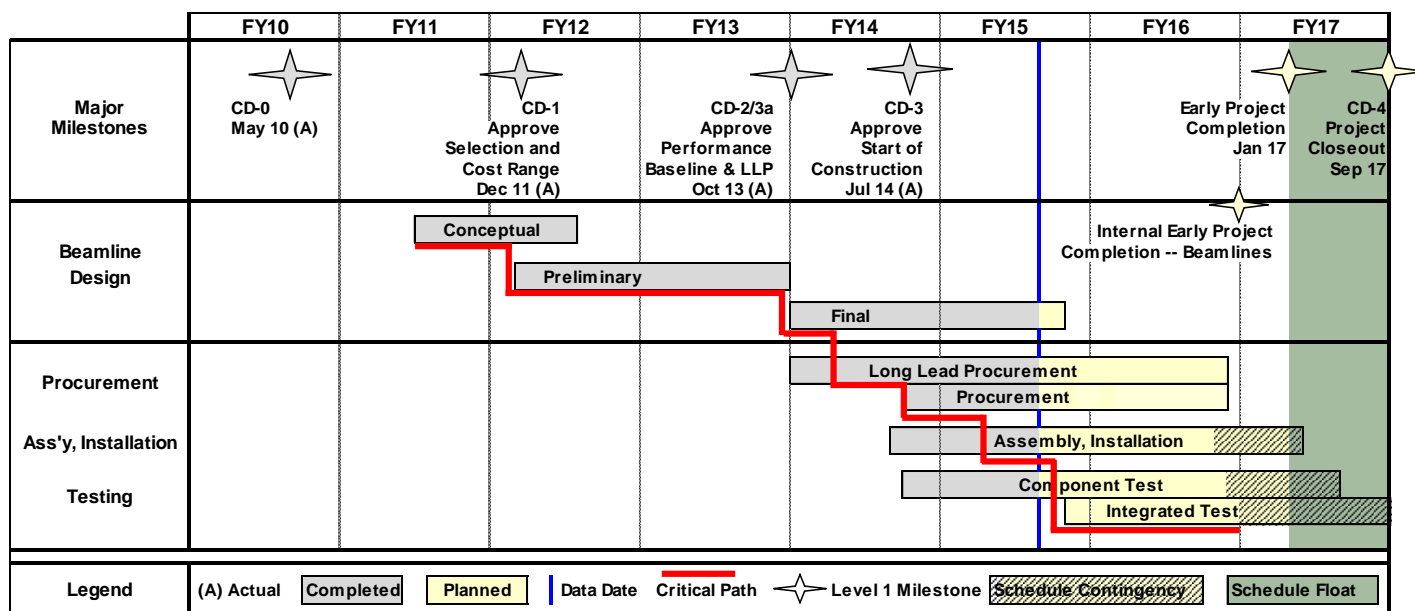
0.99

*Cause & Impact: No reportable variance

Corrective Action: None required

Milestones – Near Term		Planned	Actual	Notes
L2,L3	Receive ISS Gas Handling System	17-Mar-15		Expect June & July (2 shipments)
L3	SIX – Award Spectrometer Grating Chamber	17-Mar-15	4-Feb-15	
L3	ISS – Award XES Spectrometer	21-May-15		Expect June

PROJECT SCHEDULE



The project critical path runs through activities in WBS 2.10 (SMI beamline). As of May 2015, the active critical path activity is specification, procurement, design, fabrication, delivery, installation, and testing of the SMI Double Crystal Deflector, which delivers the SMI x-ray beam of varying energy to a fixed point on the surface of liquid samples in the liquids endstation (SMI ES1).

Staffing Report

Staffing as of 5/31/2015	Current Period		Cumulative-to-Date	
	Planned (FTE-yr)	Actual (FTE-yr)	Planned (FTE-yr)	Actual (FTE-yr)
WBS 2.01 Project Management and Support	0.73	1.00	25.15	26.30
WBS 2.02 Conceptual and Advanced Conceptual Design	0.00	0.00	8.74	8.74
WBS 2.03 Common Beamline Systems	0.88	0.36 *	13.40	4.39 *
WBS 2.04 Control System	1.36	0.51	12.57	8.85
WBS 2.05 ESM Beamline	0.50	0.56	8.90	9.35
WBS 2.06 FXI Beamline	0.00	0.06	4.62	4.39
WBS 2.07 ISR Beamline	0.43	0.39	8.84	8.79
WBS 2.08 ISS Beamline	0.20	0.36	8.10	8.93
WBS 2.09 SIX Beamline	0.37	0.47	12.58	13.07
WBS 2.10 SMI Beamline	0.24	0.34	8.45	8.67
WBS 2.11 Insertion Devices	0.35	0.13	2.91	1.98
WBS 2.12 ID & FE Installation	0.64	0.27	2.09	1.57
Total	5.71	4.45	116.35	105.03

* Utilities installation is being performed by contractors (mostly M&S) rather than staff as originally planned

Number of individuals who worked on NEXT during May 2015: 112

Funding Profile

Funding Type	NEXT Funding Profile (\$M)						
	FY11	FY12	FY13	FY14	FY15	FY16	Total
OPC	3.0						3.0
TEC – Design		3.0	2.0				5.0
TEC – Fabrication		9.0	10.0	25.0	22.5	15.5	82.0
Total Project Cost	3.0	12.0	12.0	25.0	22.5	15.5	90.0

Key NEXT Personnel

Title	Name	Email	Phone
Federal Project Director	Robert Caradonna	rcaradonna@bnl.gov	631-344-2945
NEXT Project Manager	Steve Hulbert	hulbert@bnl.gov	631-344-7570

COST PERFORMANCE REPORT

CONTRACT PERFORMANCE REPORT												FORM APPROVED			
FORMAT 1 - WORK BREAKDOWN STRUCTURE												OMB No. 0704-0188			
1. CONTRACTOR			2. CONTRACT			3. PROGRAM			4. REPORT PERIOD						
a. NAME			a. NAME			a. NAME			a. FROM (YYYYMMDD)						
Brookhaven National Laboratory						NSLS-II Experimental Tools (NEXT) Project			2015 / 05 / 01						
b. LOCATION (Address and ZIP Code)			b. NUMBER			b. PHASE			b. TO (YYYYMMDD)						
									2015 / 05 / 31						
			c. TYPE			d. SHARE RATIO			c. EVMS ACCEPTANCE						
									X YES						
WBS (3)			CURRENT PERIOD				CUMULATIVE TO DATE				AT COMPLETION				
Work Package			BUDGETED COST		ACTUAL	VARIANCE		BUDGETED COST		ACTUAL	VARIANCE		BUDGETED	ESTIMATED	VARIANCE
ITEM	WORK	COST	WORK	COST	WORK	WORK	COST	WORK	WORK	COST	SCHEDULE	COST	(14)	(15)	(16)
(1)	SCHEDULED	PERFORMED	PERFORMED	(4)	SCHEDULE	(5)	(6)	SCHEDULED	PERFORMED	(9)	(10)	(11)			
2.01.01 Project Management	74,451	74,451	72,160	0	2,291	3,093,507	3,093,507	2,987,938	0	105,569	4,657,379	4,657,379	0		
2.01.02 Project Support	106,196	106,196	198,307	0	-92,111	3,284,483	3,284,483	3,859,522	0	-575,039	5,135,530	5,711,690	-576,160		
2.02.02 Conceptual Design and Analysis of Photon Delivery Systems	0	0	0	0	0	849,881	849,881	849,881	0	0	849,881	849,881	0		
2.02.04 ESM Advanced Conceptual Design	0	0	0	0	0	101,376	101,376	101,376	0	0	101,376	101,376	0		
2.02.05 FXI Advanced Conceptual Design	0	0	0	0	0	120,634	120,634	120,634	0	0	120,634	120,634	0		
2.02.06 ISR Advanced Conceptual Design	0	0	0	0	0	210,700	210,700	210,700	0	0	210,700	210,700	0		
2.02.07 ISS Advanced Conceptual Design	0	0	0	0	0	163,508	163,508	163,508	0	0	163,508	163,508	0		
2.02.08 SIX Advanced Conceptual Design	0	0	0	0	0	179,533	179,533	179,533	0	0	179,533	179,533	0		
2.02.09 SMI Advanced Conceptual Design	0	0	0	0	0	181,684	181,684	181,684	0	0	181,684	181,684	0		
2.03.01 Utilities	123,125	128,449	316,614	5,324	-188,165	3,174,462	2,726,747	3,323,327	-447,716	-596,580	3,466,339	3,765,112	-298,773		
2.03.02 Personnel Protection System (PPS)	76,826	9,526	48,358	-67,300	-38,832	459,044	470,331	744,685	11,286	-274,354	1,323,218	1,372,823	-49,605		
2.03.03 Equipment Protection System (EPS)	4,726	24,456	33,964	19,730	-9,508	262,150	193,877	333,510	-68,274	-139,633	594,451	707,256	-112,805		
2.03.04 Control Station	4,740	17,125	12,677	12,385	4,448	27,018	17,125	42,925	-9,893	-25,800	295,394	295,394	0		
2.03.05 Common Beamline Systems Management	8,410	8,410	15,809	0	-7,399	359,815	359,815	433,843	0	-74,028	476,689	476,689	0		
2.04.01 Control System Management	6,185	6,185	2,488	0	3,697	196,590	196,590	140,433	0	56,157	294,427	294,427	0		
2.04.02 Control System Design & Implementation	207,504	73,814	82,490	-133,690	-8,676	1,867,497	1,380,670	1,528,202	-486,827	-147,532	2,912,234	2,912,234	0		
2.04.03 Control System Equipment	98,263	36,274	59,451	-61,989	-23,177	1,066,480	925,935	891,177	-140,545	34,758	1,332,188	1,314,254	17,934		
2.05.01 ESM Management	10,463	10,463	6,753	0	3,709	388,960	388,960	376,940	0	12,021	692,100	692,100	0		
2.05.02 ESM Beamline Systems	507,601	449,693	236,600	-57,908	213,093	4,922,373	4,889,848	4,403,460	-32,525	486,388	8,505,536	8,567,215	-61,679		
2.06.01 FXI Management	0	0	9,823	0	-9,823	409,359	409,359	453,080	0	-43,721	409,359	409,359	0		
2.06.02 FXI Beamline Systems	33,864	0	4,323	-33,864	-4,323	984,887	1,088,120	550,860	103,233	537,259	1,408,965	1,408,965	0		
2.07.01 ISR Management	25,041	25,041	24,178	0	864	655,172	655,172	649,111	0	6,061	1,076,573	1,076,573	0		
2.07.02 ISR Beamline Systems	236,354	257,730	227,783	21,376	29,947	2,235,082	2,142,034	2,187,629	-93,048	-45,594	9,119,886	9,204,902	-85,016		
2.08.01 ISS Management	18,102	18,102	13,998	0	4,105	465,743	465,743	458,015	0	7,729	838,199	838,199	0		
2.08.02 ISS Beamline Systems	230,542	271,466	425,074	40,924	-153,608	4,760,173	4,594,842	4,429,033	-165,330	165,810	9,049,177	9,462,360	-413,183		
2.09.01 SIX Management	17,134	17,134	18,555	0	-1,421	412,199	412,199	416,093	0	-3,894	845,551	845,551	0		
2.09.02 SIX Beamline Systems	164,945	308,631	665,871	143,687	-357,239	4,439,526	4,487,020	4,701,085	47,495	-214,064	11,344,363	11,344,363	0		
2.10.01 SMI Management	22,396	22,396	19,105	0	3,291	495,426	495,426	439,973	0	55,452	918,583	918,583	0		
2.10.02 SMI Beamline Systems	525,133	540,748	572,541	15,615	-31,793	3,397,870	3,487,228	3,602,399	89,358	-115,171	8,811,142	8,838,459	-27,317		
2.11.01 ESM EPU Insertion Device	130,643	234,795	176,910	104,152	57,885	1,215,000	1,189,493	621,943	-25,507	567,550	4,562,016	4,562,016	0		
2.11.02 SIX EPU Insertion Device	0	0	0	0	0	117,137	117,137	70,375	0	46,762	117,137	117,137	0		
2.11.03 Insertion Devices Management	2,455	2,455	1,832	0	623	49,859	49,859	27,126	0	22,733	100,460	100,460	0		
2.12.01 ID & FE Installation & Testing Management	2,458	2,458	1,317	0	1,141	10,325	10,325	4,812	0	5,513	31,153	31,153	0		
2.12.02 ID Installation & Testing	1,350	8,773	28,956	7,424	-20,183	87,733	44,474	152,289	-43,259	-107,816	423,921	423,921	0		
2.12.03 FE Installation & Testing	170,582	11,525	29,397	-159,057	-17,872	305,816	134,649	252,621	-171,167	-117,972	562,708	562,708	0		
Total Project Baseline	2,809,490	2,666,298	3,305,336	-143,192	-639,038	40,951,003	39,518,284	39,889,721	-1,432,718	-371,437	81,111,996	82,718,598	-1,606,603		
Undistributed Budget															
Management Reserve															
Performance Management Baseline - PMB	2,809,490	2,666,298	3,305,336	-143,192	-639,038	40,951,003	39,518,284	39,889,721	-1,432,718	-371,437	81,111,996	82,718,598	-1,606,603		